Elizabeth Santos Ribeiro

Validation of psychometric characteristics validity and reliability of Portuguese version of Identification of Functional Ankle Instability (IdFAI).

Projeto elaborado com vista à obtenção
do grau de Mestre em Fisioterapia no ramo de Especialidade em Músculo-Esqueléticas

Orientador: Professor Mestre José Esteves, Professor Adjunto, Fisioterapeuta

Coorientador: Professor Doutor Rui Soles Gonçalves, Professor Adjunto, Fisioterapeuta

Julho, 2020

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Abstract

Introduction: The Identification of Functional Ankle Instability (IdFAI) is a self-reported questionnaire to identify chronic ankle instability in individuals. In order to be able to compare studies from different origins, it is important to have a measurement instrument that, with the main psychometric characteristics, is recognized and used at an international level, allowing similar results to be collected under similar conditions.

Objectives: To test the validity (construct validity) and reliability (internal consistency, reproducibility) of the Portuguese version of de IdFAI.

Methods: 43 participants were included in the validity and internal consistency assessment, of which 34 were included in the reproducibility. The participants complete the Portuguese version of IdFAI, CAIT and AII, these two questionnaires were chosen because they were the basis for the development of the original IdFAI; sociodemographic and clinical data was collected; participants who agreed were assessed again 48 hours later and complete the IdFAI questionnaire again. Data were collected for left and right side. The IdFAI scores were reproduced in two ways: one that ignores item 1 (IdFAI Total 1) and another that considers the all the items (IdFAI total 2). For better analysis it was presented the results for the right ankle, left ankle and the worst ankle.

Results: The IdFAI scale demonstrated high Cronbach's alpha in the right ankle 0.832 (IdFAI Total 1) and 0.837 (IdFAI Total 2); for the left ankle 0.800 (IdFAI Total 1) and 0.831 (IdFAI Total 2); and for the worst ankle 0.765 (IdFAI Total 1) and 0.764 (IdFAI Total 2). Internal consistency was similar to those obtained in other studies. Corrected item-total results demonstrated, for the right, left and worst ankle moderate correlations. The reproducibility of each item of IdFAI, for the right ankle, showed scores from 0.976 to 1; 0.953 to 1 for the left ankle and 0.973 to 1 for the worst ankle. The Portuguese version of IdFAI had a strong correlation with the Portuguese versions of CAIT and AII.

Conclusion: The Portuguese version of IdFAI obtained in this study is a highly reliable and valid self-report questionnaire that can be used to assess ankle instability in Portuguese population. The results obtained in this study demonstrated psychometric characteristics

comparable to the other language versions of IdFAI, including the original version of this questionnaire.

Key words: physiotherapy, chronic ankle instability, Identification of Functional Ankle Instability (IdFAI)

Resumo

Introdução: O Identification of Functional Ankle Instability (IdFAI) é um questionário de auto preenchimento usado para identificar a instabilidade crónica do tornozelo em indivíduos. Para poder comparar estudos de diferentes origens, é importante haver um instrumento de medida que, com as principais características psicométricas, seja reconhecido e utilizado a nível internacional, permitindo que os resultados sejam semelhantes quando recolhidos em condições semelhantes.

Objetivos: Testar a validade (validade de construção) e fiabilidade (consistência interna e reprodutividade) da versão portuguesa do IdFAI.

Metodologia: 43 participantes foram incluídos na avaliação da validade e consistência interna, deste, 34 foram incluídos na reprodutividade. Os participantes preencheram a versão portuguesa do IdFAI, CAIT e AII, estes dois questionários foram escolhidos porque serviram de base para o desenvolvimento da versão original do IdFAI; dados sociodemográficos e clínicos também foram recolhidos; os participantes que concordaram, foram avaliados 48 horas depois e preencheram o questionário IdFAI novamente. Os dados foram recolhidos para o lado esquerdo e direito. As pontuações do IdFAI foram reproduzidas de duas formas: uma que ignora o item 1 (IdFAI Total 1) e outra que considera todos os itens (IdFAI total 2). Para uma melhor análise, os resultados foram reproduzidos para o tornozelo direito, tornozelo esquerdo e tornozelo pior.

Resultados: A escala IdFAI demonstrou um alfa de Cronbach alto, no tornozelo direito 0,832 (IdFAI Total 1) e 0,837 (IdFAI Total 2); para o tornozelo esquerdo 0,800 (IdFAI Total 1) e 0,831 (IdFAI Total 2); e para o pior tornozelo 0,765 (IdFAI Total 1) e 0,764 (IdFAI Total 2). A consistência interna foi semelhante à obtida em outros estudos. O coeficiente item-total demonstrou, uma correlação moderada para o tornozelo direito, esquerdo e para o tornozelo pior. A reprodutividade de cada item do IdFAI, para o tornozelo direito, apresentou scores de 0,976 a 1; 0,953 a 1 no tornozelo esquerdo e 0,973 a 1 no tornozelo pior. A versão portuguesa do IdFAI teve uma forte correlação com as versões em português do CAIT e AII.

Conclusão: A versão portuguesa do IdFAI obtida neste estudo apresentou alta validade e fiabilidade, e que é um instrumento que pode ser usado para avaliar a instabilidade do

tornozelo na população portuguesa. Os resultados obtidos neste estudo demonstraram que as características psicométricas são comparáveis a outras versões linguísticas do IdFAI, incluindo a versão original deste questionário.

Palavras-chave: fisioterapia, instabilidade crónica do tornozelo, Identification of Ankle Instability (IdFAI)

Introduction

The most common musculoskeletal disorder documented in physically active populations, but also in the general community, is the lateral ankle sprain (LAS) (Hiller, Kilbreath, & Refshauge, 2011). It accounts for 77%-83% of all sprain conditions (Fong, Hong, Chan, Yung, & Chan, 2007). At least 302.000 and 1-2 million sprains occur per year in the UK and USA, respectively. The main consequence is the high rate of recidivism, which can affect approximately 8% of the general population (Hiller, et al., 2012).

LAS usually result in injuries to the passive ligamentous structures of the ankle. So, the forceful ankle plantar flexion and inversion, that is the most common mechanism of injury, frequently leads to total tearing of the lateral ligaments of the ankle itself, specifically, the anterior talofibular ligament (ATFL), reported to be the weakest and the first ligament injured. Rupture of the ATFL is followed by damages to the calcaneofibular ligament (CFL) and posterior talofibular ligament (PTFL) (Hertel, Denegar, Monroe, & Stokes, 1999). Severe LAS causes pain and usually results in a period of reduced function and disability (Gribble, et al., 2016). Treatment for LAS is quite variable, with many patients returning to activity in a short period of time, however, half of those never seek initial treatment (Doherty, Bleakley, & Hertel, 2016).

The persistence of ankle spraining, after an initial episode, is called chronic ankle instability (CAI), and is characterized by a multifactorial condition involving mechanical and/or functional instabilities (Delahunt, 2007). The most commonly cited characteristics of CAI include giving way of the ankle, mechanical instability, pain and swelling, loss of strength, recurrent sprain, and functional ankle instability (FAI) (Gribble, et al., 2016). Anatomical changes in the ankle complex occur after the initial sprain, resulting in mechanical instability that weakens and exposes the ankle to other episodes of instability. These changes include impaired arthrokinematics, pathologic laxity, synovial changes, and the development of degenerative joint disease, which may occur in isolation or combination (Hertel, 2002). FAI consists of recurring faults after an initial sprain that results in adverse changes to the neuromuscular system that provides dynamic support to the ankle. The residual symptoms associated with FAI include ankle muscle strength decreases, proprioception and postural control impairment, a delay in the fibular muscle reaction time,

and a functionality decrease in the ankle, with or without ligament laxity and pain (Delahunt, Coughlan, Nightingale, Lin, & Hiller, 2010).

In 40% to 60% of individuals who have suffered at least one ankle sprain, are reported incidents in which the ankle "giving way ". For individuals with CAI, had been showed that approximately 6% return to routine, and 5-15% of them remain limited in their functions for at least 9 months up to 6.5 years due to residual symptoms (Hootman , Dick, & Agel, 2007).

For evaluating self-reported ankle instability in individuals with CAI, the International Ankle Consortium recommends the use of patient report outcome and questionnaires with validated specific cut-off scores (Gribble , et al., 2013) such as Ankle Instability Instrument (AII) (Docherty, Gansneder, Arnold, & Hurwitz, 2006), Cumberland Ankle Instability Tool (CAIT) (Hiller, Kilbreath, & Refshauge, 2011), and Identification of Functional Ankle Instability (IdFAI) (Donahue, Simon, & Docherty, 2011).

In 2012, Janet Simon, together with her collaborators, published an article in which they present the instrument of measurement "Identification of Functional Ankle Instability (IdFAI)". The IdFAI was designed to determine the severity of ankle instability in individuals with CAI with specific cut-off scores (Simon, Donahue, & Docherty, 2012). The original version of IdFAI showed excellent discriminative validity (area under receiver operating characteristic [ROC] curve: 0.91 (0.88 – 0.94) and high test-retest reliability (intra-class correlation [ICC2,1]: 0.92 to 0.98) (Gurav, Ganu, & Panhale , 2014). The precision of the IdFAI is the culmination of combining the main advantages of the AII and CAIT to clearly define the historical CAI symptom of "giving away" in individuals with CAI (Simon, Donahue, & Docherty, 2012). In order for a measuring instrument to be used in a language, culture or country other than the one in which the original version was developed, it must be subjected to a process of cultural and linguistic adaptation and to the testing of the psychometric characteristics of the new version (Yasir, 2016).

In order to be able to compare studies from different origins, it is important to have a measurement instrument that, with the main psychometric characteristics, is recognized and used at an international level, allowing similar results to be collected under similar conditions. Therefore, psychometric properties, such as reliability and validity must be

assessed and considered appropriate before a health measurement instrument is used for research or clinical practice (Mokkink L. , Terwee, Patrick, & et al, 2010).

Validity checks to see if the instrument measures exactly what it is intended to measure. Assesses the ability of an instrument to accurately measure the phenomenon to be studied (Mokkink L. , et al., 2010). Reliability is the ability to reproduce a result consistently over time and space, or with different observers (Terwee, et al., 2007).

The aim of this study was to test the validity (construct validity) and reliability (internal consistency, reproducibility) of the Portuguese version of de IdFAI.

Methods

Subjects

The sample consisted of individuals from two higher education institutions, a clinic and a company in the district of Viseu, Portugal.

Subjects were selected after obtaining formal informed consent and checking the inclusion and exclusion criteria. To be included in this validation study, subjects had to have at least one ankle sprain and to be aged 18 to 55 years. Subjects were excluded if they had history of surgery, fracture of the lower limb, and nervous system disorders.

Instruments

The IdFAI consists of 10 items focusing on the history of ankle sprains, the presence and severity of ankle instability; and functional performance in daily living and other physical activities. The scores, based on the ranking of the chosen response for each item, need to be summated to calculate a total score. The minimum score is 0 with higher scores indicating decreased ankle function. The question 1 of IdFAI asks for the number of ankle sprains after that the final IdFAI scores can be reproduced in two ways; one that gives a score of 0 to 37 points, if we exclude item 1 (that we refer to in this study as ‘Total IdFAI 1’); and

one that gives a score of 0 to ≥ 37, if we include item 1 (that we refer in this study as ‘Total IdFAI 2’).

Individuals are unlikely to have FAI when the total score is 10 or less than 10, and individuals are likely to have FAI when the total score is 11 or greater.

The test-retest reliability of the original version of IdFAI was characterized by excellence (intra-class correlation, ICC = 0.92) (Donahue, Simon, & Docherty, 2012) and overall accuracy of 89,6% (Simon, Donahue, & Docherty, 2012). Regarding the process of cultural and linguistic adaptation of IdFAI to the Portuguese population, it has been previously performed and semantic equivalence and adequate content validity were obtained by José Esteves in collaboration with the Center for Health Studies and Research (CEISUC) (2016). It was this Portuguese version of IdFAI that was submitted to the validation process in this study.

Ankle Instability Instrument (AII) is a questionnaire with 12 questions that allows us to determine the range of severity of FAI. The scores of AII range from 0 to 9. Each question has closed answers, namely “yes” and “no”. Participating individuals who answer "yes" to five or more questions are considered to have chronic ankle instability. The AII shows an intra class correlation coefficient of 0.95 ± 1.85 for the overall instrument. The internal consistency, indicated by Cronbach's alpha, was 0.89 for this questionnaire (Docherty, Gansneder, Arnold, & Hurwitz, 2006).

Cumberland Ankle Instability Tool (CAIT) is a reliable, valid and a simple tool for measurement and identification of severity of FAI. It consists of a 9 items and a 0 to 30 points scale. If the total score is equal to or lower than 27, individuals are likely to have functional ankle instability. Regarding the internal consistency, this scale has a Cronbach's alpha of 0.83 and has a reliability index of 0.99. At the same time, still in the analysis of this criterion, the test-retest value using ICC was characterized by excellence (ICC = 0.96) and a Spearman correlation > 0.5 (Hiller, Refshauge, Bundy, Herbert, & Kilbreath, 2006). The Portuguese version of this instrument and the AII that was used in this study was the translated, adapted and validated version by Costa (2016) in collaboration with CEISUC.

Procedures

Patients were assessed, during the visit of the physical therapist responsible for this study, in the institutions above mentioned and they were asked to complete the Portuguese version of IdFAI, CAIT and AII; and a demographic and clinic characteristic.

The patients who agreed were assessed again 48 hours later for the same physical therapist and they were asked to complete only the IdFAI questionnaire. This period of time was considered large enough so that the individuals were unable to memorize previous answers.

Data were collected for left and right side. The IdFAI scores were reproduced in two ways: one that ignores item 1 (IdFAI Total 1) and another that considers the 10 items (IdFAI total 2). For better analysis it was presented the results for the right ankle, left ankle and the worst ankle.

Statistical analysis

The statistical analysis was performed using SPSS software version 24.0. Descriptive statistics were used to characterize the sample. Mean and standard deviation values were used to describe the quantitative variables. Frequency and percentage values were used to describe the categorical variables.

Reliability. Internal consistency was assessed using Cronbach's alpha coefficient and corrected item-total correlations. It is considered a good internal consistency when Cronbach's alpha value is between 0.70-0.95 (Terwee, et al., 2007). Corrected item-total scale correlation higher than 0.30 are considered adequate and therefore measure the same construct (Streiner & Norman, 2008). Reproducibility of IdFAI was assessed using intra class correlation coefficient (ICC). For the instrument to be considered reliable, it is suggested a minimum value of 0.70 (Terwee, et al., 2007)

Validity. Construct validity was analyzed using Spearman's correlation. For the right, left and worst ankle we verified the correlation of IdFAI (Total 1 and 2) with the CAIT and AII questionnaires. Spearman's correlation are very high correlation if higher than or equal

to 0.90; high correlation if between 0.89 and 0.70; moderate correlation if between 0.69 and 0.40; low correlation if between 0.39 and 0.20, very low correlation if lower than or equal to 0.19 (de Vet, Ader, Terwee, & Pouwer, 2005).

Results

Subjects

A total of 43 participants were included in the validity and internal consistency assessment, of which 34 (70,1%) were included in the reproducibility assessment. The descriptive statistics of the anthropometric and clinical characteristics, and the scores of the instruments used are shown in table I.

Table I - Anthropometric and clinical characteristics

Characteristics	Total Sample (N = 43)	Reproducibility (N = 34)*
Gender		
Female	**21 (48.8)**	**13 (38.2)**
Male	**22 (51.2)**	**21 (61.8)**
Age (years)	**30.4 ± 12.4**	**30.5 ± 13.1**
Height (m)	**169.8 ± 8.4**	**170.1 ± 8.4**
Weight (kg)	**69.4 ± 10.7**	**70.8 ± 10.2**
Body mass index (kg/m2)	**23.9 ± 2.7**	**24.4 ± 2.5**
Time since last ankle sprain (months)	**58.8 ± 70.9**	
Number of days of activity stopped due to the sprain	**13.2 ± 19.3**	**55.5 ± 67.7**
Limb dominance		
Right	**37 (86.0)**	**31 (91.2)**
Left	**6 (14.0)**	**3 (8.8**
Ankle Sprain History		
Suffered an ankle sprain	**43 (100)**	**34 (100)**
Suffered more than one sprain in a single ankle		
Yes	**22 (51.2)**	**18 (52.9)**
No	**21 (48.8)**	**16 (47.1)**
Involved knee		
Right	**28 (65.1)**	**22 (64.7)**
Left	**15 (34.9)**	**12 (35.3)**
Last Sprain History		
Currently under treatment		
Yes	**2 (4.7)**	**2 (5.9)**
No	**41 (95.3)**	**32 (94.1)**
Sprain presented signs of inflammation		
Yes	**32 (74.4)**	**24 (70.6)**
No	**11 (25.6)**	**10 (29.4)**
Stopped activity due to sprain		
Yes	**33 (76.7)**	**24 (70.6)**
No	**10 (23.3)**	**10 (29.4)**
Aids necessary		
Yes	**14 (32.6)**	**10 (29.4)**
No	**29 (67.4)**	**24 (70.6)**
Right Ankle		

Scores IdFAI (points)		
IdFAI total 1 (9 items)	**6.9 ± 7.0**	**7.4 ± 7.4**
IdFAI total 2 (10 items)	**8.5 ± 7.8**	**9.1 ± 8.2**
Scores AII (points)	**2.4 ± 2.2**	**2.5 ± 2.2**
Scores CAIT (points)	**26.1 ± 5.3**	**25.4 ± 5.5**
Left Ankle		
Scores IdFAI (points)		
IdFAI total 1 (9 items)	**5.1 ± 5.9**	**5.8 ± 6.3**
IdFAI total 2 (10 items)	**6.3 ± 6.9**	**7.2 ± 7.4**
Scores AII (points)	**1.8 ± 2.2**	**2.1 ± 2.3**
Scores CAIT (points)	**26.6 ± 5.3**	**25.7 ± 5.6**
Worst Ankle		
Scores IdFAI (points)		
IdFAI total 1 (9 items)	**8.9 ± 6.7**	**9.7 ±7.0**
IdFAI total 2 (10 items)	**10.9 ± 7.2**	**11.8 ± 7.5**
Scores AII (points)	**3.1 ± 2.1**	**3.3 ± 2.1**
Scores CAIT (points)	**25.4 ± 5.4**	**24.5 ± 5.5**

Quantitative variables: mean ± standard derivation; Categorical variables: frequency (percentage)
IdFAI total 1 from 0 to 37 points, best to worst; IdFAI total 2 from 0 to ≥37 points, best to worst; CAIT from 0 to 30 points, worst to best; AII from 0 to 9 points, best to worst.
* Group in which all subjects were reassessed after 48 h.

Reliability

Internal Consistency was assessed using Cronbach's alpha coefficient and corrected item-total correlations. The Cronbach's alpha of the Portuguese version of IdFAI, for the right ankle had values of 0.832 for the IdFAI Total 1 and 0,837 for IdFAI Total 2. For the left ankle shows values of 0,800 for IdFAI total 1 and 0,831 for IdFAI Total 2. Finally, to the worst ankle showed values of 0.765 for the IdFAI Total 1 and 0.764 for the IdFAI Total 2 (table II). Results of the item analyses are showed in table III.

Table II – Reliability of the IdFAI

	IdFAI (number of items)	**Cronbach's alpha coefficient(N=43)**	**Intraclass coefficient correlation (confidence intervals 95%) (N=34)***
Right Ankle	**IdFAI total 1 (9 items)**	0.832	0.999 (0.997 – 0.999)
	IdFAI total 2 (10 items)	0.837	0.998 (0.996 – 0.999)
Left Ankle	**IdFAI total 1 (9 items)**	0.800	1 (0.999 - 1)
	IdFAI total 2 (10 items)	0.831	0.999 (0.997 – 0.999)
Worst Ankle	**IdFAI total 1 (9 items)**	0.765	0.999 (0.997 – 0.999)
	IdFAI total 2 (10 items)	0.764	0.998 (0.995 – 0.999)

* The questionnaire was administered twice, separated by 48 hours.

Table III – Reliability of the IdFAI items

10 items of IdFAI	Right Ankle Corrected item-total coefficients (N=43) *	Right Ankle Corrected item-total coefficients (N=43) †	Right Ankle Intraclass coefficient correlation (Confidence intervals 95%) (N=34) ‡	Left Ankle Corrected item-total coefficients (N=43) *	Left Ankle Corrected item-total coefficients (N=43) †	Left Ankle Intraclass coefficient correlation (Confidence intervals 95%) (N=34) ‡	Worst Ankle Corrected item-total coefficients (N=43) *	Worst Ankle Corrected item-total coefficients (N=43) †	Worst Ankle Intraclass coefficient correlation (Confidence intervals 95%) (N=34) ‡
IdFAI 1	-	0.460	0.977 (0.955 – 0.988)	-	0.656	0.974 (0.949 – 0.987)	-	0.281	0.973 (0.947 – 0.986)
IdFAI 2	0.508	0.578	1	0.482	0.473	0.993 (0.987 – 0.997)	0.254	0.255	1
IdFAI 3	0.252	0.263	0983 (0.967 – 0.992)	0.393	0.439	1	0.126	0.142	0.984 (0.969 – 0.992)
IdFAI 4	0.239	0.219	1	0.261	0.328	1	0.111	0.090	1
IdFAI 5	0.655	0.657	1	0.711	0.678	1	0.724	0.745	1
IdFAI 6	0.829	0.783	0.980 (0.961 – 0.990)	0.692	0.672	1	0.799	0.762	0.980 (0.961 – 0.990)
IdFAI 7	0.693	0.701	0.985 (0.970 - 0,992)	0.697	0.684	1	0.648	0.651	0.985 (0.971 – 0.992)
IdFAI 8	0.612	0.658	0.995 (0.990 – 0.997)	0.607	0.653	0.994 (0.987 – 0.997)	0.499	0.550	0.994 (0.987 – 0.997)
IdFAI 9	0.699	0.634	0.976 (0.952 – 0.988)	0.683	0.644	0.953 (0.909 – 0.976)	0.712	0.659	0.976 (0.953 – 0.988)
IdFAI 10	0.807	0.773	1	0.612	0.599	1	0.714	0.689	1

* Obtained for IdFAI Total 1.

† Obtained for IdFAI Total 2.

‡ The questionnaire was administered twice, separated by 48 hours.

Corrected item total scale correlations of IdFAI total 1 ranged from 0.239 to 0.829 in the right; 0.261 to 0.711 in the left ankle and 0.111 to 0.799 in the worst ankle. The total IdFAI 2 ranged from 0.219 to 0.783 in the right ankle; 0.328 to 0.684 in the left ankle and 0.090 to 0.762 in the worst ankle.

The reproducibility of IdFAI total 1 between the first and second administration was excellent for the right ankle (ICC=0.999), the left ankle (ICC=1) and worst ankle (ICC=0.999). For the IdFAI total 2 the values are excellent to, to the right ankle (ICC=0.998), left ankle (ICC=0.999) and worst ankle (ICC=0.998) (Table II).

Validity

The correlation between the IdFAI Total 1 and 2 and the CAIT and AII, for the right, left and worst ankle, were confirmed (Table IV, Table V and VI).

Table IV – Construct Validity of IdFAI (N=64), correlation between questionnaire scores IdFAI, CAIT and AII for the right ankle

			IdFAI scores (points)	
			IdFAI Total 1	IdFAI Total 2
Right Ankle	**CAIT scores**	rho	-0.738**	-0.715**
	(points)	p	0.000	0.000
	AII scores	rho	0.865**	0.875**
	(points)	p	0.000	0.000

Spearman's correlation coefficients (IdFAI total 1 from 0 to 37 points best to worst; IdFAI total 2 from 0 to ≥37 points, best to worst; CAIT from 0 to 30 points, worst to best; AII from 0 to 9 points, best to worst).
**Significant level correlations 0.01

Table V – Construct Validity of IdFAI (N=64), correlation between questionnaire scores IdFAI, CAIT and AII for the left ankle

			IdFAI scores (points)	
			IdFAI Total 1	IdFAI Total 2
Left Ankle	**CAIT scores**	rho	-0.757**	-0.767**
	(points)	p	0.000	0.000
	AII scores	rho	0.861**	0.860**
	(points)	p	0.000	0.000

Spearman's correlation coefficients (IdFAI total 1 from 0 to 37 points, best to worst; IdFAI total 2 from 0 to ≥37 points, best to worst; CAIT from 0 to 30 points, worst to best; AII from 0 to 9 points, best to worst).
**Significant level correlations 0.01

Table VI – Construct Validity of IdFAI (N=64), correlation between questionnaire scores IdFAI, CAIT and AII for the worst ankle

			IdFAI scores (points)	
			IdFAI Total 1	IdFAI Total 2
Worst Ankle	**CAIT scores (points)**	rho	-0.681**	-0.673**
		p	0.000	0.000
	AII scores (points)	rho	0.768**	0.755**
		p	0.000	0.000

Spearman's correlation coefficients (IdFAI total 1 from 0 to 37 points, best to worst; IdFAI total 2 from 0 to ≥37 points, best to worst; CAIT from 0 to 30 points, worst to best; AII from 0 to 9 points, best to worst).
**Significant level correlations 0.01

Discussion

The aim of this study was to test the measurement properties. The results indicated that the Portuguese version of IdFAI is a valid and reliable measure and can be used in Portugal in patients with FAI. All results indicated that this version exhibited good psychometric properties.

The scale demonstrated high Cronbach's alpha in the right ankle 0.832 (IdFAI Total 1) and 0.837 (IdFAI Total 2); for the left ankle 0.800 (IdFAI Total 1) and 0.831 (IdFAI Total 2); and for the worst ankle 0.765 (IdFAI Total 1) and 0.764 (IdFAI Total 2). Internal consistency were similar to those obtained in other studies such as 0.89 by Ko et al. (2017), 0.87 by Martinez et al (2018), 0.95 by Mohamadi et al (2018), 0.87 by Mineta et al (2019) and 0.89 by Li et al (2017).

Corrected item-total results (Table III) demonstrated, for the right ankle, that the items were moderately related, in the IdFAI Total 1 and IdFAI total 2, however, an increase was observed when item 3 and 4 was omitted from the scales (in IdFAI Total 1 and IdFAI Total 2). In the left ankle, the results of corrected item-total demonstrated that the items were moderately correlated, in the IdFAI total 2 the values were higher than 0.30 but in the IdFAI Total 1 was observed an increase when item 4 was omitted from the scale. In the worst ankle a significant increase was observed where item 3 and 4 was omitted from the scale, in Total IdFAI 1 and in the Total IdFAI 2; apart from this the other items showed moderate correlation (Total IdFAI 1 and Total IdFAI 2). Item 3 in the IdFAI is a question regarding if the patient consulted a physical therapist, doctor or other health professional and how did he classify the most severe sprain in the ankle; the item 4 in the IdFAI is a question regarding if patient used walking aids due to a sprained ankle and if he did how long. These values may be related to the fact that, even if the participants had suffered an

ankle sprain, whether or not they used walking aids, or have consulted a health professional to classify the severity of the sprain, it is not indicative that they have functional ankle instability. The main propose of IdFAI is to identify individuals with FAI (Simon, Donahue, & Docherty, 2012).

The reproducibility of each item of IdFAI, for the right ankle, showed scores from 0.976 to 1; 0.953 to 1 for the left ankle and 0.973 to 1 for the worst ankle (Table III). Total scores of the Portuguese version of IdFAI was excellent for the right ankle, with values of ICC=0.999 (IdFAI Total 1) and ICC=0.998 (IdFAI Total 2); in the left ankle this version showed excellent results with ICC=1 (IdFAI Total 1) and ICC=0.999 (IdFAI Total2), and for the worst ankle showed values of ICC=0.999 (IdFAI Total 1) and ICC=0.998 (IdFAI Total2) with a time interval of 48 hours (Table II). These results for reproducibility were similar to those achieve with other versions of IdFAI, even using different time interval between repeated administrations, such as 0.99 by Korean version (with a time interval of 1 week) (Ko, Rosen, & Brown, 2017), 0.97 by Brazilian version (with a time interval of 2 weeks) (Martinez, et al., 2018), 0.91 by Persian version (with a time interval of 1 week) (Mohamadi, et al., 2018), 0.96 by Japanese version (with an average time interval of 30 days) (Mineta, et al., 2019) and 0.97 by Chinese version (with a time interval of 1 week) (Li, et al., 2017). The Portuguese version of IdFAI demonstrated higher or similar reproducibility to the other international versions. These findings indicate that is a reliable instrument when used on the same day or at an interval of 48 hours.

The Portuguese version of IdFAI had a strong correlation with the Portuguese versions of CAIT and AII, these two questionnaires were chosen because they were the instruments used in the development of the original IdFAI. This version of IdFAI showed, for the right ankle, a high correlation, between IdFAI total 1 with CAIT ($r=-0.738$, $p<0.01$) and a high correlation between IdFAI total 1 with AII ($r=0.865$, $p<0.01$), high correlations between IdFAI total 2 and CAIT ($r=-0.715$, $p<0.01$) and IdFAI total 2 and AII ($r=0.875$, $p<0.01$). For the left ankle we can observe that the correlations between IdFAI total 1 and CAIT ($r=-0.757$, $p<0.01$) and IdFAI total 1 and AII ($r=-0.861$, $p<0.01$) are high, same to the correlation between IdFAI total 2 and CAIT ($r=0.767$, $p<0.01$) and IdFAI total 2 with AII ($r=0.860$, $p<0.01$). For the worst ankle, a moderate correlation was observed between IdFAI Total 1 with CAIT ($r=-0.681$, $p<0.01$) and high correlation between IdFAI Total 1 and AII ($r=0.768$, $p<0.01$), moderate correlation between IdFAI Total 2 and CAIT ($r=-0.673$, $p<0.01$) and high correlation between IdFAI Total 2 and AII ($r=0.755$, $p<0.01$).

With these results we can state that the results obtained in the psychometric properties are comparable when using different scoring procedures and when considering different ankle sides.

Limitations

Some limitations of this study should be acknowledged.

The sample used in this study were small and isn't representative of the entire Portuguese population, and most subjects did not had CAI.

Another limitation to consider is the fact that the clinical significance and responsiveness of the Portuguese version of IdFAI were not assessed, which would have been of great importance to give strength to this validation study.

Conclusion

The Portuguese version of IdFAI obtained in this study is a reliable and valid self-report questionnaire that can be used to assess ankle instability in Portuguese population.

The results obtained in this study demonstrated psychometric characteristics results comparable to the other versions of IdFAI including the original version of this questionnaire.

In the future, we propose, to carry out further studies in order to assess the responsiveness and the clinical significance of this measure and use a larger sample.

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